Coastal Flood Management

Global Innovations

Tuesday, 13 December 2005

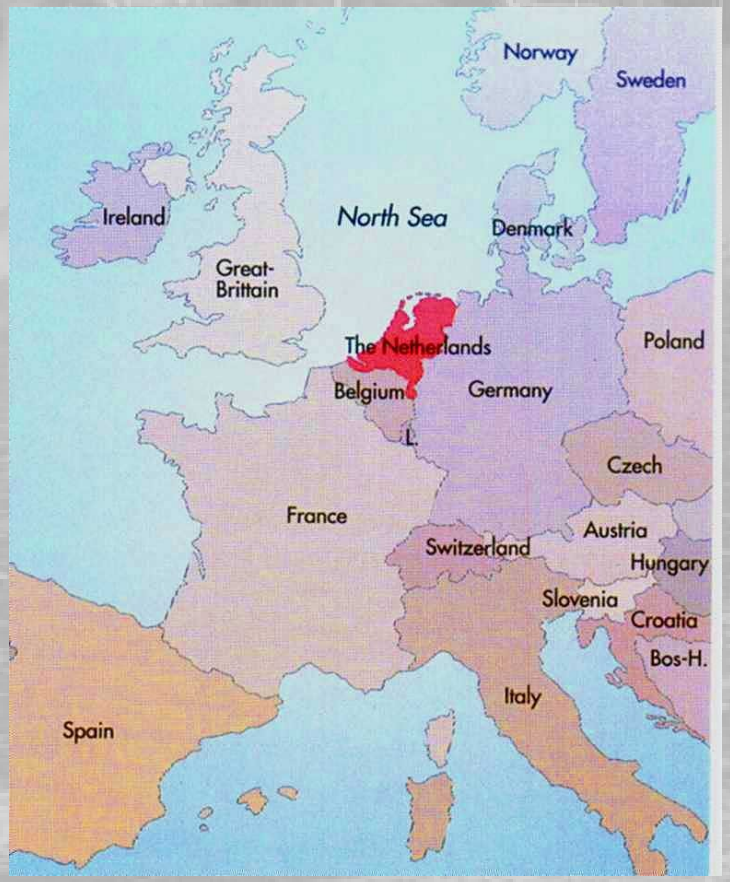
Today's program

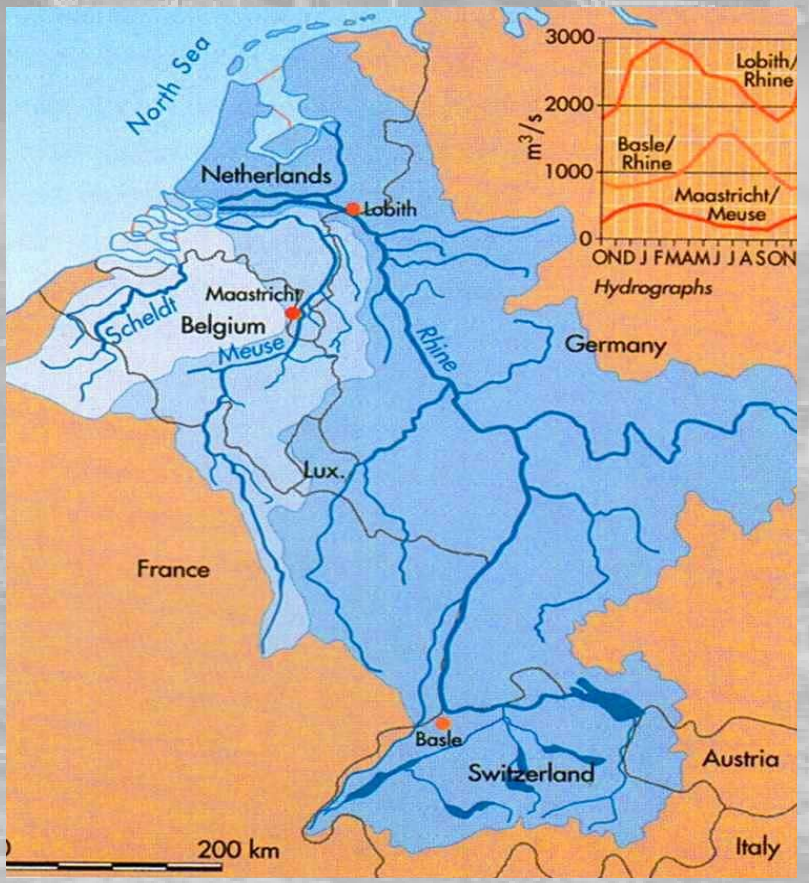
0930 –1200: **Morning Session**

1330 – 1530: **Afternoon Session**

- **Topic One:** Establishing Flood Protection Criteria
- **Topic Two:** Innovative Global Flood Control Barriers
- **Topic Three:** Innovative Approaches to Levee Design, Construction, and Monitoring
- **Topic Four:** Project Documentation for Quality Compliance
- **Topic Five:** Instrumentation Database Management
- **Topic Six:** Flood Protection Planning for New Orleans and the Louisiana Coast

Situation of The Netherlands





Establishing Flood Protection

“Founding a Nation on Swamps”

Looking into the past to learn about the future

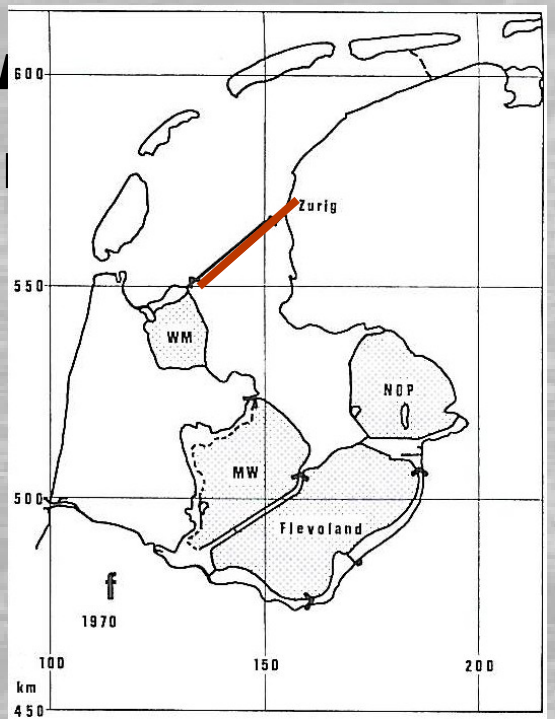
1: Overall histor
2: Southern Sea
3: Delta Project
4: River Projects
5: Coastal Visio
6: Safety levels

Founding a Nation on Swamps

- From 12th century onwards: cultivation of fertile land
- Organized via “Water Boards”
- Many serious floodings changed the maps
- Standard responses:
  - Increase the heights of the dikes

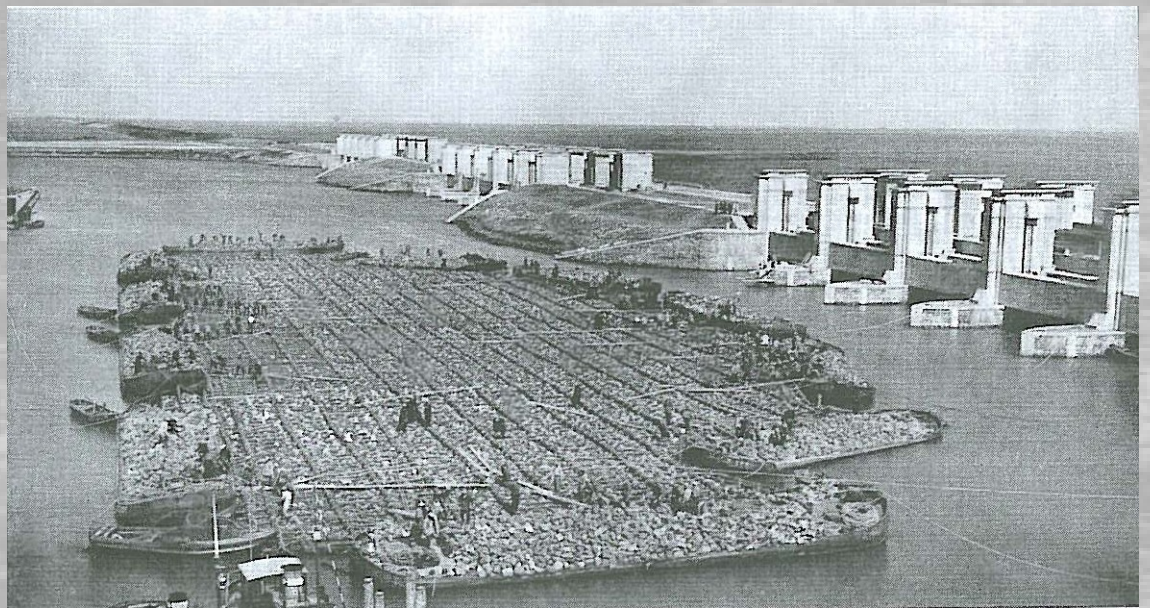
The Southern Sea Project

- Former lake, now tidal bay
- Surrounding areas vulnerable to flo
- Weak dikes (poor foundation)
- Continuing need for agricultural land
- Most smaller lakes were already dew
- Various plans to close off the southe
- One final plan (private initiative)



The Closure dam

- **Important element: The Closure dam**
  - **to ease the construction of the new polders**
  - **to shorten the line of defense (from 1900 to 1250 km)**
- **The construction started only in 1920 (35 years later)**



The Southern Sea Project

- Southern Sea (salt) became IJssel Lake (fresh)
- Two huge sluice complexes for river run-off (8 billion m^3/y)
- 1968: last polder (total 640 sq miles new agricultural land)
- Important role for science

The Delta Project

- Immediate cause : 1953 flooding
- The country was poorly protected
- Approach: closure of the estuaries by various types of structures

The Delta Project

The various dams

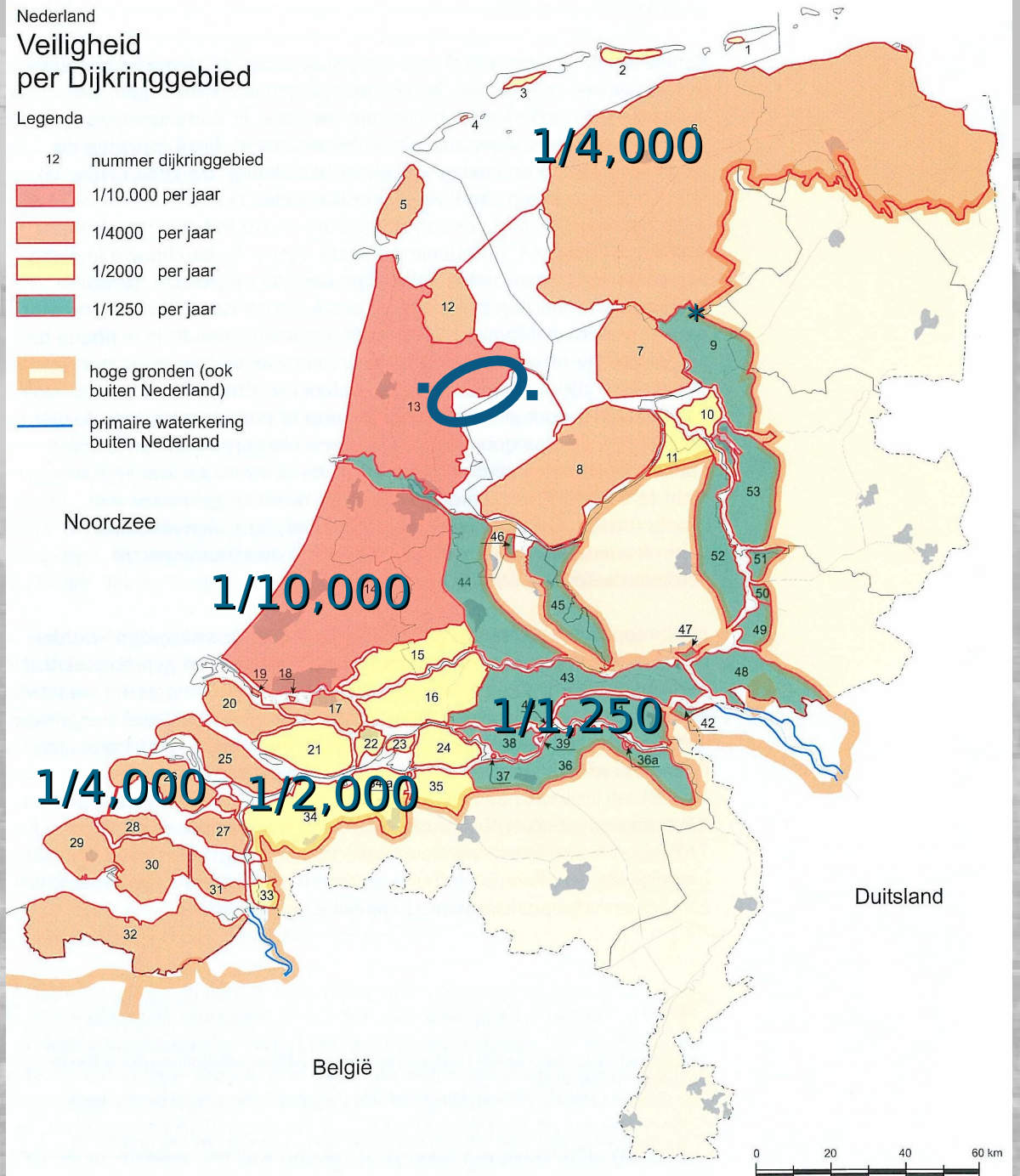
- (Additional) Advantages:
  - Tools for national water management
  - Improving agricultural conditions (fresh water)
  - Better access to region (roads over the dams)
  - Tide-free connection between ports
  - Object of interests for visitors
- Disadvantages
  - Deposition of polluted sediments
  - Deterioration of estuarine ecosys

Design Safety Levels

- What safety level was actually required?
- Risk-based approach (probabilistic)

  Risk = Probability * Potential Damage

- Strategy: protect only what “deserves” to be protected
- No statistical data but flood marks
- Input for political arena where the choices were made
- Leading to “accepted flood probabilities” per specific area.
- Flooding probabilities were translated into water level exceedance frequencies


Nederland
Veiligheid
per Dijkringgebied
Legenda
12 nummer dijkringgebied
1/10.000 per jaar
1/4000 per jaar
1/2000 per jaar
1/1250 per jaar
hoge gronden (ook buiten Nederland)
primaire waterkering buiten Nederland
Noordzee
1/4,000
1/10,000
1/1,250
1/4,000
1/2,000
Duitsland
België
0 20 40 60 km

Current Flood Protection Policy

- Legal framework
- Regular maintenance
- Review all levees every five years
- Coastline maintenance based on sand nourishment

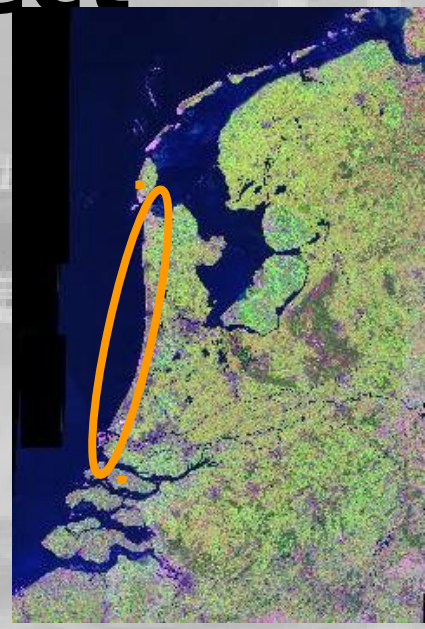
River levee restoration

- Immediate cause: “almost-floods” of 1993/1995
- (evacuation of 250.000 people)
- Not so well protected against river flood
- Emergency levee reinforcement works

The “Space for the Rivers” - Project

- Immediate cause: acknowledgement of the effects of climate change (long term)
- Further raising the levees would not be sufficient
- Solution: lower the (design) water level!
- How: by giving more space to the river run-off
- Increase the width of the river bed
  - For safety,
  - For recreation, ecology, quality of life, …
- Importance of participative government

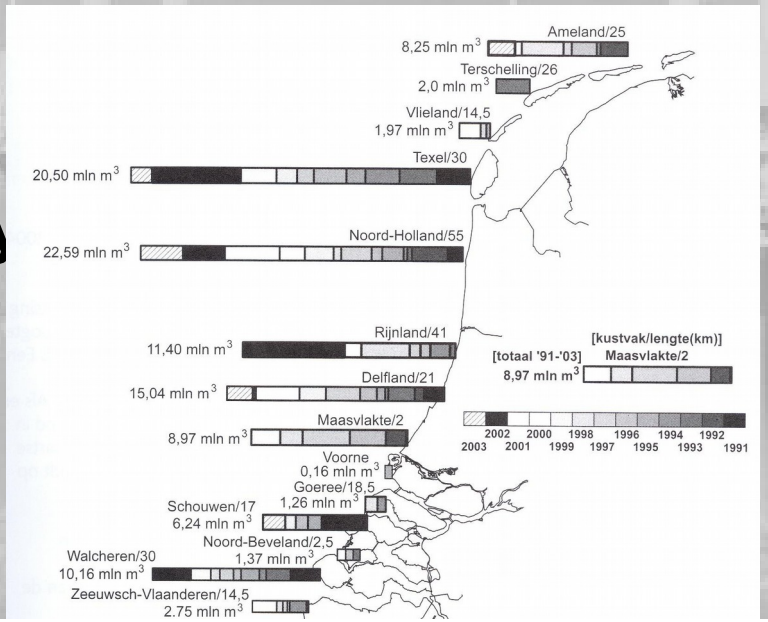
The Coastal Vision 2050 Project



- Immediate cause: long-term developments in combination with increased human pressure
- Threats:
  - Accelerated sea level rise
  - Increased storm attacks
  - Much more at stake (compared to the Fifties)
- Challenges: Spatial development in the flood-prone areas
- Morphological studies and spatial planning combined

Four important issues

- **Shoreline management (policy**



Overview of cumulative nourishment volume

- **Maintaining safety for the hinterland (by l**

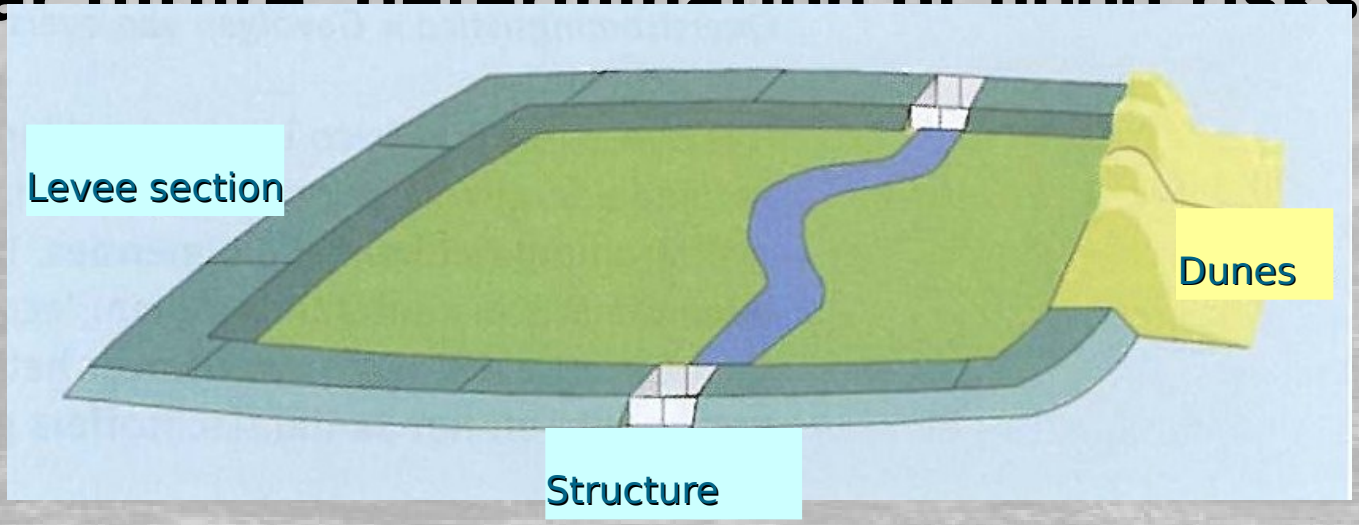
The Coastal Vision 2050 Project

- **Control the risks in the frontline (regulations, no criteria**

- **Control overtopping of the sea dikes (not one defense line, but a defense zone)**

Risk-Based Approach

- From: probability of exceedance of water levels
- To: probability of flooding of a dike ring area
- Near future: determination of flood risks



- Example: further compartment of larger dike ring areas

Conclusions

- Required to reach major achievements:
  - Vision, strategy, technical excellence,
  - Sense of urgency
  - Effective government
- Military analogy: reduce the length of the frontline
- Risk-based analysis: Defend what deserves to be protected
- Consider levee rings rather then levee sections (weak spots)
- The trigger today is climate change
- Importance of science (beta, and alpha, gamma sciences)

We prepare for them